

TITLE OF THE INVENTION
IMAGE READING APPARATUS

FIELD OF THE INVENTION

5 The present invention relates to an image reading apparatus and, more particularly, to an image reading apparatus having two different reading systems, i.e., a reading system in which an original is fixed on an original glass plate and an optical system scans it to
10 read image information, and a reading system in which an optical system is fixed and an original is moved so image information is read from it.

BACKGROUND OF THE INVENTION

15 A conventional image reading apparatus has two different reading systems, i.e., a reading system in which an original is fixed on an original glass plate and an optical system scans it to read image information, and a reading system in which an optical
20 system is fixed and an original is moved so image information is read from it.

Fig. 3 is a view showing the arrangement of a conventional image reading apparatus, and shows a reading system in which an optical system is fixed and
25 image information of an original 120 is read while the original 120 is conveyed by a DF (abbreviation for a document feeder), although not shown. The original 120

is moved by the DF. When the original 120 passes above a scan flow glass member 104, it is illuminated through a light source 106 and reflecting member 107. A light beam reflected by the original 120 is transmitted
5 through a slit 108 and forms an image on a line sensor 113 such as a CCD by an imaging lens 112 through first, second, and third mirrors 109, 110, and 111. As the original 120 moves at a constant speed, the line sensor 113 such as a CCD reads it at a predetermined timing,
10 so the image information of the original 120 can be read.

When an original 130 is placed on an original glass plate 101, while it is illuminated by the light source 106 and reflecting member 107 of an illuminating
15 portion, the light source 106, reflecting member 107, slit 108, and first mirror 109 cooperate with each other to scan it in the subscanning direction indicated by an arrow X in Fig. 3. At the same time, the second and third mirrors 110 and 111 move in the subscanning
20 direction indicated by the arrow X. Thus, the image information on the original 130 is read by the line sensor 113 such as a CCD.

When an image reading apparatus is formed with the above arrangement, an original such as a book, a
25 thin original which is difficult to convey with the DF, or the like can be read if it is placed on the original glass plate 101. Simultaneously, a sheet-type original

can be read while it is moved on the scan flow glass member 104. In particular, if the original can be read by the latter scan flow scheme, it can be read quietly because it is not scanned by an optical system, and can
5 be read at a high speed.

In the prior art described above, the optical system is fixed and the original is read while being conveyed, that is, so-called scan flow operation is performed, so the advantages such as quietness and
10 higher speed are realized. However, due to dust attaching to the scan flow glass member 104, or a scar on the glass plate itself, the following problems arise.

Currently, the above image reading apparatus generally has a reading density of about 400 dpi to
15 600 dpi. In this case, a pixel with a size of $63.5 \mu\text{m}$ is read at 400 dpi, and a pixel with a size of $42.3 \mu\text{m}$ is read at 600 dpi. When dust or a scar is present on the scan flow glass member 104, even if it is as very small as several tens μm , a streak is formed on a read
20 image or a copy image formed from the read image because of the dust or scar described above.

Since the optical system is fixed, in the scan flow mode, the same one position on the scan flow glass member 104 is always read. When dust or a scar is
25 present on this position, this problem also occurs.

With the ordinary original glass plate 101, even if dust or a scar is present on it, when a read image

is formed or a copy image is formed from the read image,
a single image degraded point of as small as several
tens μm is merely formed. As described above, in the
case of the scan flow mode, when dust or a scar is
5 present at the reading position, it forms a streak from
the leading edge to the trailing edge of the image,
making the image very bad-looking. Accordingly, the
image reading apparatus like that of the prior art is
imposed a very heavy load in terms of the manufacture
10 of the scan flow glass plate at the factory, management
of dust or scar at the time of shipping, cleaning on
the market, and the like.

SUMMARY OF THE INVENTION

15 The present invention has been made in
consideration of the above problems, and has as its
object to provide an image reading apparatus in which
image reading (scan flow) while the original is being
moved is performed above the scan flow glass member, so
20 image degradation caused by dust or a scar on the scan
flow glass member can be prevented.

In order to solve the above problems and to
achieve the above object, an image reading apparatus
according to the present invention has the following
25 arrangement.

More specifically, there is provided an image
reading apparatus comprising two different reading

systems constituted by a reading system in which an original is fixed on an original glass plate and an optical system scans the original to read image information, and a reading system in which an optical system is fixed and image information is read while moving the original, wherein an original illumination system, different from an original illumination system that illuminates the original placed on the original glass plate, is arranged above a scan flow glass member arranged on substantially the same plane as that of the original glass plate and used when reading image information while moving the original, an original convey device is formed to move the original above the different original illumination system, the original which is being conveyed is directly illuminated by the different original illumination system, and switching means is provided for switching a focal surface of the original.

Namely, according to the present invention, an image reading apparatus is formed such that a position where a position where image information is read from an original in conveyance is set at position different from a position on the original glass plate, and that the original is read in midair. Since the position for reading the conveyed original is set above the scan flow glass member arranged on the same plane as that of the original glass plate, dust or a scar on the scan

flow glass member, which conventionally poses a problem,
goes out of focus. Thus, a streak is prevented from
being formed on the read image. Also, since the
original is read not through the glass plate
5 immediately under it, it is not adversely affected by
dust or scar.

According to the present invention, the focal
surface of the optical system in the image reading
apparatus can be moved. Simultaneously, an
10 illumination system for illuminating the original in
conveyance is separately provided in the DF. No glass
member is arranged above another illumination system
for illuminating this original, i.e., immediately under
the original. The original is directly read in midair.

15 Other features and advantages besides those
discussed above shall be apparent to those skilled in
the art from the description of a preferred embodiment
of the invention which follows. In the description,
reference is made to accompanying drawings, which form
20 a part hereof, and which illustrate an example of the
invention. Such example, however, is not exhaustive of
the various embodiments of the invention, and therefore
reference is made to the claims which follow the
description for determining the scope of the invention.

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BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view for explaining an image reading

apparatus according to an embodiment of the present invention;

Fig. 2 is a view for explaining another embodiment of the present invention;

5 Fig. 3 is a view for explaining a conventional image reading apparatus; and

Fig. 4 is a view showing an example of an image that poses a problem in the prior art.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of the present invention will be described with reference to the accompanying drawings.
[First Embodiment]

Fig. 1 is a view showing the arrangement of an
15 image reading apparatus according to the first embodiment of the present invention. In this image reading apparatus, an original 20 conveyed by a convey roller 15 is illuminated by an illumination system comprised of an illumination light source 16 and
20 reflecting member 17 and different from an illumination system in the reading apparatus body and comprised of an illumination light source 6 and reflecting member 7. After a light beam reflected by the original 20 passes through a slit 18 and scan flow glass member 4, it
25 forms an image on a line sensor 13, e.g., a CCD, by an imaging lens 12 through a movable mirror 14.

A DF (Document Feeder; not shown) is formed such

that the original 20 moves at a position which is about 20 mm to 50 mm above the scan flow glass member 4 with almost the same focal surface as that of an original glass plate 1.

5 In the illumination system in the image reading apparatus body, as shown in Fig. 3, when the original 20 passes above the scan flow glass member 4, it is illuminated through the illumination light source 6 and reflecting member 7, and the light beam reflected by
10 the original 20 is transmitted through a slit 8 and forms an image on the line sensor 13, e.g., a CCD, by the imaging lens 12 through first, second, and third mirrors 9, 10, and 11.

 In this arrangement, the original 20 which is
15 being moved is illuminated by the illumination system comprised of the illumination light source 16 and reflecting member 17 and different from the illumination system in the reading apparatus body and comprised of the illumination light source 6 and
20 reflecting member 7. After a light beam reflected by the original 20 passes through the slit 18 and scan flow glass member 4, it forms an image on the line sensor 13, e.g., a CCD, by the imaging lens 12 through the movable mirror 14. As the original 20 moves at a
25 constant speed, it is read by the line sensor 13, e.g., a CCD, at a predetermined timing, thereby obtaining the image information of the original 20.

As described above, the original 20 is located, e.g., about 20 mm to 50 mm above the scan flow glass member 4. Even if dust or a scar of about several tens μm is present on the scan flow glass member 4, it goes out of focus as it is away from the focal surface by about 20 mm to 50 mm, so it can be prevented from forming an absent point of the line sensor 13 such as a CCD. Therefore, the problem of a streak as shown in Fig. 4, which occurs in a read image or in a copy image formed from the read image, can be solved.

A mechanism for changing the focal surface to above the scan flow glass member 4 will be described. As shown in Fig. 1, the so-called first mirror table in the image reading apparatus body and comprised of the illumination light source 6, reflecting member 7, slit 8, and first mirror 9 for reading an original 30 placed on the original glass plate 1 by scanning it in the subscanning direction, and the so-called second mirror table comprised of the second mirror 10 and third mirror 11 are moved to the left end in the image reading apparatus body.

Subsequently, the movable mirror 14 is raised (usually, retreated to a position not interfering with the scanning optical system) as shown in Fig. 1. Hence, the focal surface moves upward from the scan flow glass member 4 by a distance A which is twice that between the first and second mirrors 9 and 10 corresponding to

the scan flow position, e.g., a distance B shown in Fig. 3, i.e., a distance 2B. In this embodiment, the optical system is arranged in the optimal manner so that A (about 20 mm to 50 mm) = $2B$.

5 The focal surface is moved by about 20 mm to 50 mm. For example, in an image reading apparatus that reads an image with an original size of A_3 , the optical path length from the original glass plate 1 to the line sensor 13 such as a CCD is usually about 500 mm to 600 mm. When the focal surface is moved by about 20 mm to 50 mm, dust or a scar with a size of about several tens μm can be set out of focus sufficiently, and is not recognized as an image signal.

[Second Embodiment]

15 According to another embodiment, as shown in Fig. 2, an imaging lens 12 and a line sensor 13, e.g., a CCD, are integrated as a unit 40. The integrated unit 40 is moved with, e.g., a motor (not shown), in a direction Y by a distance A, so the focal surface moves upward from a scan flow glass member 4 by a distance A. An image is read while moving an original 20 in the same manner as that described above. Thus, an adverse effect of dust or a scar on the scan flow glass member 4 can be prevented.

25 As has been described above, according to the above embodiments, an original illumination system, different from an original illumination system that

illuminates the original placed on the original glass
plate, is arranged above another original glass plate
arranged on substantially the same plane as that of the
original glass plate and used when reading image
5 information while moving the original, an original
convey device is formed to move the original above the
different original illumination system, the original
which is being conveyed is directly illuminated by the
different original illumination system, and switching
10 means is provided for switching a focal surface of the
original. Image reading (scan flow) from the original
which is being moved is performed above the scan flow
glass member. Thus, degradation in image caused by
dust or a scar on the scan flow glass member can be
15 prevented.

The present invention is not limited to the above
embodiments and various changes and modifications can
be made within the spirit and scope of the present
invention. Therefore, to apprise the public of the
20 scope of the present invention the following claims are
made.